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ABSTRACT

The rationale and procedures involved with the instructional strategies of concept mapping and Gowin's Vee Mapping are provided in this paper. Specific directives are outlined for building concept maps and vee maps. Examples of both types of these maps are given and explanations are offered on their form and use. Concepts and activities illustrated in the maps include: (1) hydrometer/thermometer density activity; (2) seawater density (both pre and post-instructional maps); (3) hydrometer demonstration; (4) role of thermocline in summer salmon distribution, and (5) Lake Ontario salmonid research. A bibliography of nine references is provided. (ML)

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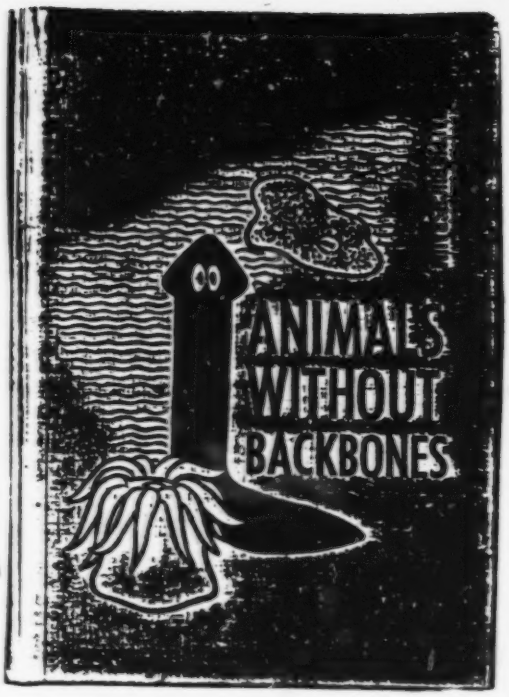

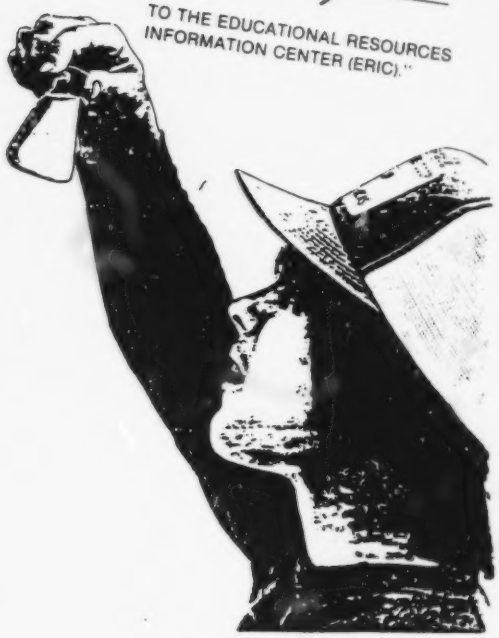

curriculum

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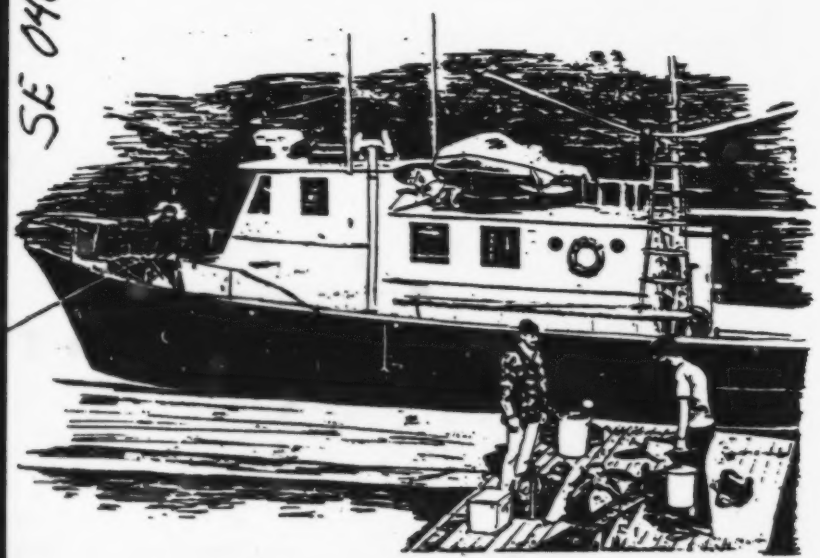


TRANSLATING RESEARCH REPORTS INTO EDUCATIONAL MATERIALS or HOW TO TAKE A NEAT PIECE OF RESEARCH AND TURN IT INTO A CURRICULUM

Michael Brody

Introduction

Science and environmental education make up an important part of the curriculum for the future. Decreasing resources, increasing pollution and advanced technology demand a society that is knowledgeable about basic science concepts, understands how they affect our lives and feels the significance of people's actions in the world. Lectures, demonstrations, laboratories and field trips are the traditional methods used by teachers in science education. Increased awareness of the need for a more science literate society requires new strategies which can relate students' understanding, science curriculum and the real world. Primary sources of knowledge such as scientific and environmental research reports can be used to teach many of the concepts found in today's curriculum. Concept Mapping and Vee Mapping can provide students with a vehicle to travel through "intellectual space", from their own understanding and knowledge, through textbooks and laboratories to application of science concepts in the world outside of the classroom.

Knowledge

Knowledge is something that human beings create. It is an artifact of culture and society. Contrary to popular opinion, it is not discovered like oil beneath the bottom of the sea. People are constantly receiving information and trying to fit, substitute or somehow integrate it into what they already know. The knowledge which individuals possess affects the way they view the world. Each of us perceives the world through our personal knowledge, as if we wear colored goggles which affect the way that we see things. The individual learner's cognitive framework, those ideas already possessed, is surprisingly robust and complex. In educating the single most important factor is what the learner already knows. Into this student framework, we as teachers, must help fit new ideas.

A curriculum, often embodied in a textbook, has a definite order or format which can also be described as a framework. Even though a teacher may alter an existing curriculum and purposefully change the framework, the curriculum still possesses a definite structure of knowledge. Through teaching and learning the frameworks of both curriculum and student must be integrated.

Those individuals involved in the business of creating knowledge, i.e. scientists/researchers, follow a construction format mediated by their own ideas or goggles. The scientific method is a reflection of this knowledge building scheme but represents only one of many possible methods. Scientists create knowledge using frameworks that interrelate concepts with methods to make claims about the world.

When asked about knowledge and it's sources, the majority of people believe it is a set of facts, found in books and is not subject to change. It is important to realize that there is an evolution of knowledge. Since it is a human construction it is subject to changes based on new information and our perception of the world.

Educating

Educating takes place when thinking, feeling and acting combine to produce meaningful learning. Meaningful learning results when new concepts from the curriculum are integrated with those the student already possesses. If students also feel the significance of new ideas, they may choose to change their behavior. Environmental education which leads to meaningful learning may lead to changes in people's actions toward the environment. Science educators may promote thinking in lectures or demonstrations, acting in laboratories and feeling during field trips. However, the three must be integrated to produce changes in student understanding and behavior.

Educating is an event centered process. Teachers create events that lead to claims about student learning. The design of educational events is an important part of curriculum development. The events constructed for educating should integrate thinking, feeling and acting and allow the teacher and student to work side by side. This can lead to greater understanding and good feelings about learning.

Researchers, like educators, create events. Their construction of knowledge is event centered and leads to claims abou the world. Science and educating events can utilize very similar concepts and thus can be integrated to form curricula. Transect studies are used in ecological studies as events to produce knowledge about particular ecosystems. Transects can also be employed as educative events when determining beach profile or zonation. The close relationship between classroom concepts and real world events can lead to more meaningful learning.

Curriculum

Curricula are educational materials that the teacher and student use to share meaning about concepts taught. In most cases teachers are presented with or choose a textbook which becomes the curriculum. Two new strategies for design of curricula and classification of existing educational materials are Concept Mapping and Gowin's Vee (or Vee Mapping).

A proven method for making texts more comprehensible for teachers and students is Concept Mapping. These maps help to identify key concepts and how these concepts relate to one another. They provide a comprehensive way of outlining printed materials, such as, texts, research reports or newspaper articles. Different maps can be drawn to illustrate simple or complex meanings in the same text. While drawing maps teachers often recognize new relationships and meanings in old and familiar material. Concept Maps can help students recognize key concepts that seem to be hidden in the text. Many times students in the midst of a course are frustrated by not knowing where the course or the instructor is headed. Teachers, don't lose your students, use a Map!

To Build a Concept Map:

1. Identify seven (plus or minus two) key concepts in a paragraph, research abstract or chapter, and list them.
2. Place the broadest and most inclusive idea at the top of the map.
3. Work down the paper, add more specific concepts.
4. Join these with lines that are labeled with action or linking words.

Each concept-linking word-concept unit forms a proposition that reads like a sentence. Concepts not in the text can be added to increase complexity and comprehensiveness. Examples of concepts can be included at the bottom of the map. (see figure 1.)

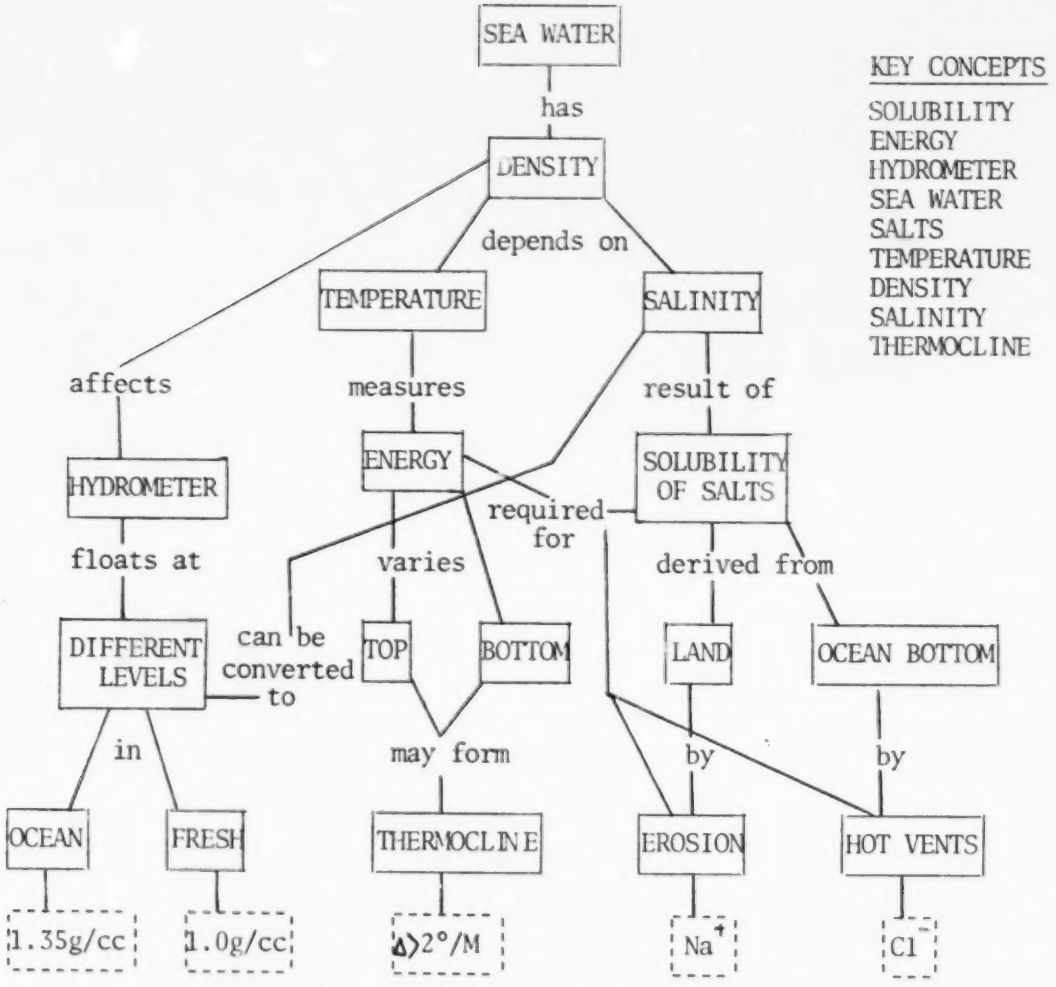


Figure 1. Concept Map of seawater focusing on density. To appreciate the hierarchical nature of Maps, cover the lower order concepts and gradually uncover each layer of concepts as you read down the Map.

The Vee Map can be used to analyze educative or research events, to prepare reports of laboratory investigations, or to plan a research project for a science fair or graduate student thesis proposal. Central to the Vee is a question and an event designed to help answer it. The Vee helps "unpack" knowledge by identifying key concepts, principles and theory. It makes apparent the relationship between methods, concepts and claims.

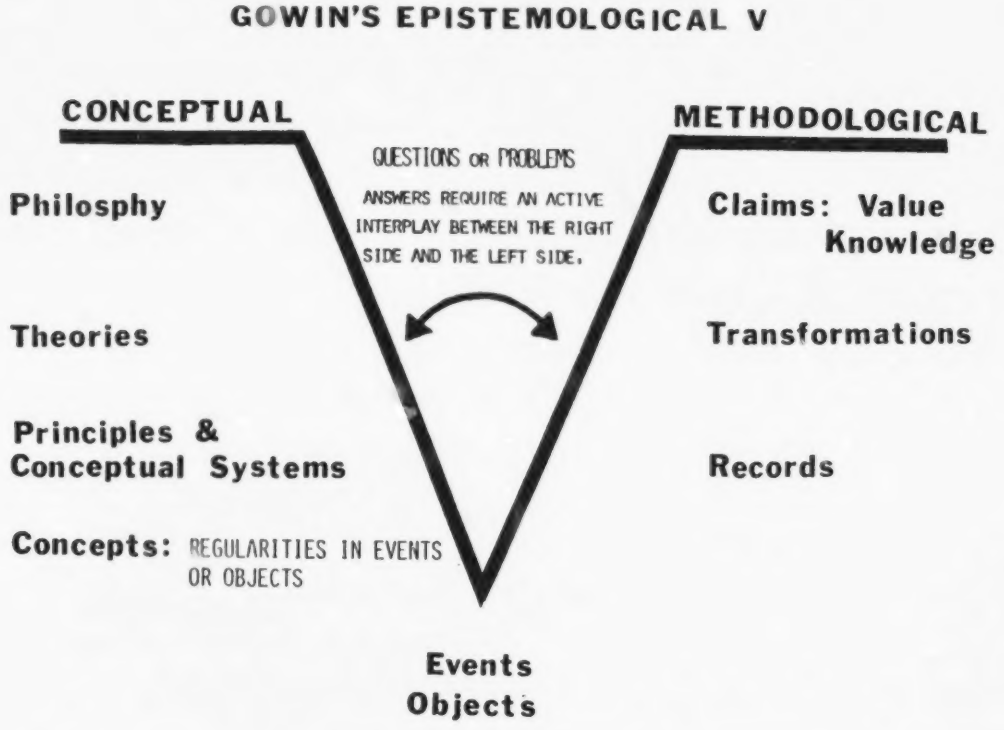


Figure 2. The Knowledge Vee showing the elements in construction of Knowledge. The left side or conceptual elements interact with the right side or methodological elements as knowledge is constructed from observing events and trying to answer questions or solve problems.

Traditional laboratory exercises can be easily analyzed using the Vee. Vee analysis helps students comprehend and integrate labs developing an understanding not always apparent when traditional purpose, procedure, results format is used. Although when constructing a Vee you can start anywhere, it has become apparent that some construction sequences are more appropriate.

To Build a Vee:

1. Identify the event; what is it that you are going to do?
2. Determine the question; why do this lab or procedure?
3. Identify the important ideas and concepts necessary to understand the event and answer the question. (Here you can make a Concept Map.)
4. Work up the left side of the Vee and include the biggest ideas, the key to the events or principles and the world view or philosophy. Most of these will answer the question: Why do these events occur?

Working up the right side of the Vee:

5. Record data.
6. Draw diagrams or graphs.
7. Determine the results. Make claims and answer the question you asked at the beginning.
8. Be sure to include the value of your work!

A common physical science demonstration relating density, temperature and salinity is Vee Mapped in Figure 3. Often when teachers demonstrate the use of a hydrometer they ask what is the difference in the liquids as they move the instrument from one to the other. Students then propose answers or the teacher may give a lecture on temperature-salinity-density relationships. Use of the Vee can help make obvious what is going on in this demonstration. The

left side of the Vee indicates those concepts which are necessary to understand the event. These concepts are most meaningful when described in terms of a Concept Map as in Figure 1. The Concept Map is an important part of the Vee and relates most closely to the event. Those concepts listed apply to or are derived from the principles, theories and philosophy listed on the left side. These help explain the event. On the right side the data is listed and then differences in observations under Transformations. Observations of the event together with the appropriate concepts lead to the claims listed on the Vee.

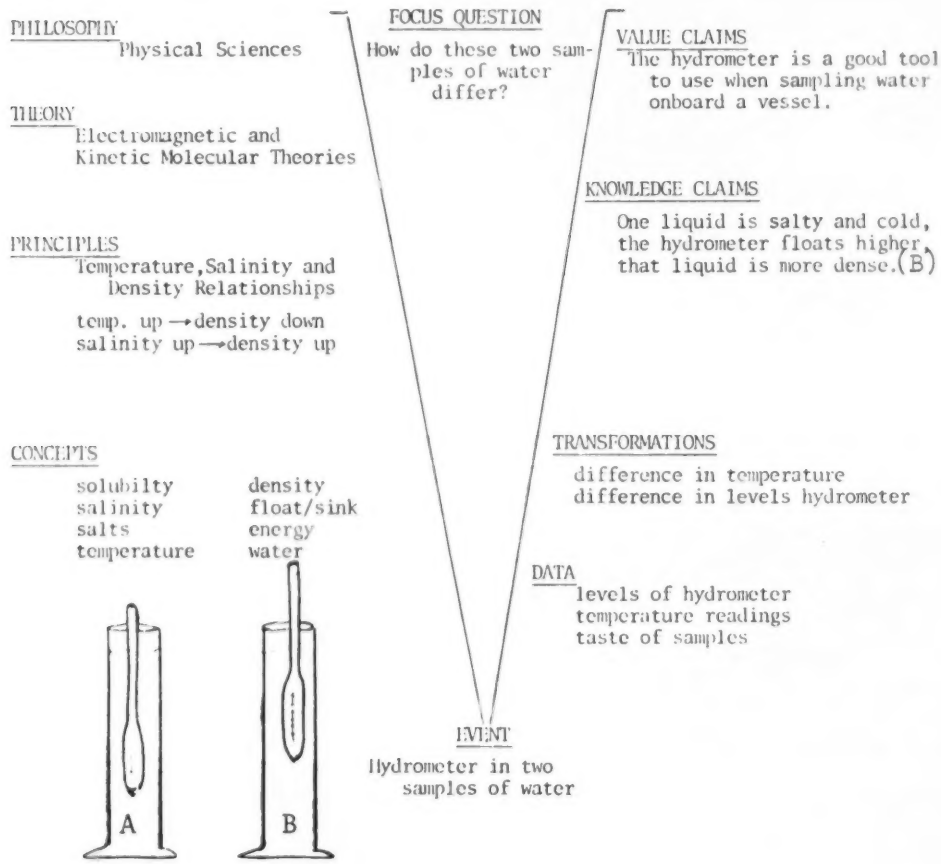


Figure 3. Vee analysis of a density activity using a hydrometer/thermometer to investigate samples of fresh and salt water.

Research reports and extension publications that use the same concepts as those found in labs, texts or lectures can be used for Vee analysis. These are available free and in quantity from many government agencies. For example, many field research programs have reports on estuarine studies that investigated the relationships among temperature-salinity-density. After students have learned key ideas and conducted experiments in lab, they can then use the Vee to take an educated look at research. This ties concepts often considered by students as "science classroom stuff" to real world examples of the application of science concepts. Applied research which is used to help improve our lives is most appropriate for students' analysis because students can them appreciate the relevance of the researcher's activities to real world situations.

Example: The Floating Lab Program
A curriculum integrating student concepts, text, demonstrations, labs, field work and research.

The University of New Hampshire Floating Lab is an exemplary marine education program in New England. Each year students are taught concepts in their classrooms before participating in an offshore oceanographic field trip. Following the voyage they return to their classrooms for data analysis and post-trip activities.

The Concept Map of seawater and density in figure 1. was constructed from information in the University of New Hampshire Floating Lab Resource Manual. The map represents some of the major concepts about seawater emphasized during the sampling field trip on board the research vessel. The map helps stress the central role of temperature and salinity in determining density. Pre-field trip instructional activities include Construction of a Homemade Hydrometer amd Determination of Salinity Based on Temperature and Density. Vee analysis of these activities resembles Figure 3. and would have identical concepts,

principles and theory. Teachers in the Floating Lab Program are asked to teach these concepts and use the activities prior to the field trip.

Onboard the vessel students take water samples from the top and bottom of the water column, both inside the harbor and offshore. They determine salinity using a hydrometer observing that the density of the water changes based on the interaction of temperature and salinity thus affecting the level at which the hydrometer floats. Using a temperature probe onboard the students often observe a thermocline, a sharp temperature gradient between warm top water and cold bottom water. Thus this concept is included in the original Concept Map. As part of the study of students' understanding of density the hydrometer demonstration was used as a prop during clinical interviews. Twenty eighth grade students were interviewed before and after instruction in the Floating Lab Program. Concept Maps were constructed from these interviews and then pre and post Maps were compared.

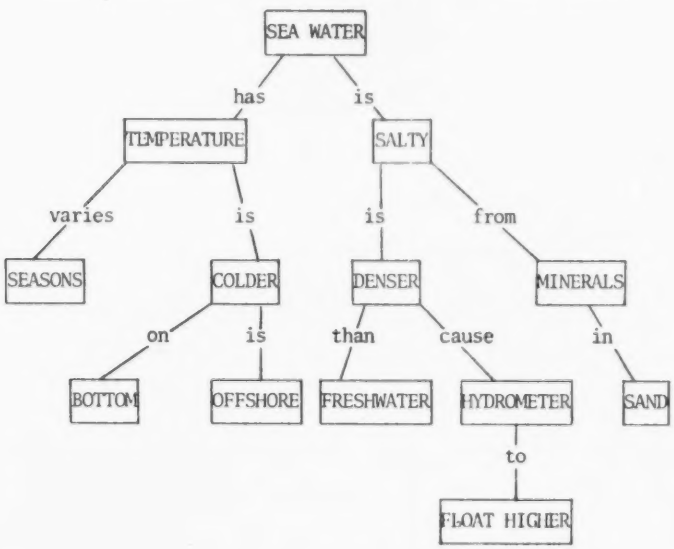


Figure 4. Concept Map of student's comments about density before instruction. The Map was constructed from an audio tape of a clinical interview using a hydrometer in two different samples of water, as a prop.

Figure 4. is a pre-instruction Concept Map of those concepts a student possessed concerning density. Since the student made no mention of the relationship between temperature and density, he might have difficulty understanding the concept of thermocline. After instruction most students learned the concepts of temperature and density and their relationship to thermocline. This is illustrated in the post-instruction map of a similar interview (see Figure 5.) Note also that the student's total number of concepts and valid propositions increased as he included concepts such as estuary and harbor. Results from these interviews have guided changes in the program which, it is hoped, will lead to increased learning and appreciation by students.

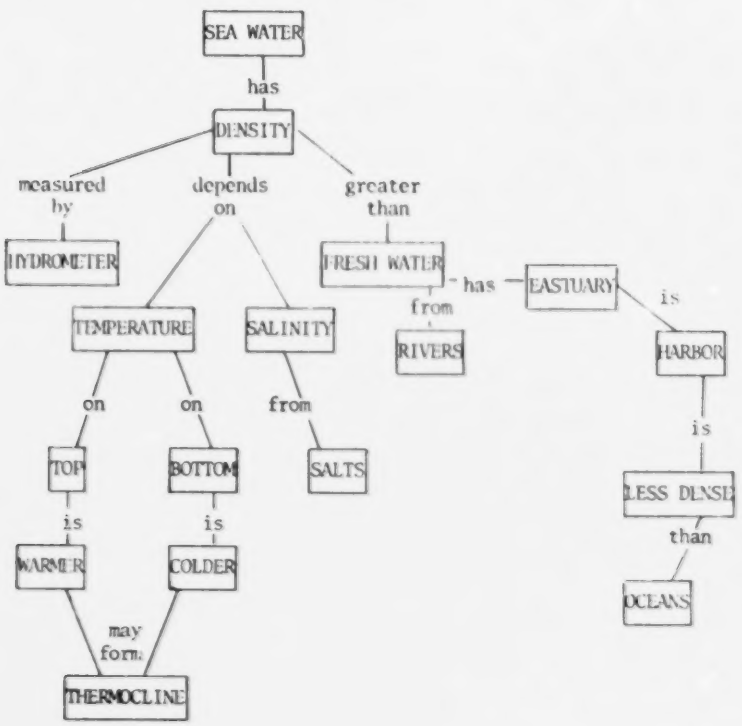


Figure 5. Concept Map of student's comments about density following the Floating Lab Program. Note the inclusion of Temperature linked to density leading to the concept of thermocline.

A post-field trip demonstration/laboratory applying the concepts of temperature, salinity and density relationships is Davy Jones' Locker (adapted from Investigating the Marine Environment-A Source Book, Vol. II). The Vee Map of Davy Jones' Locker (see Figure 6.) shares a similar conceptual left side with Figure 3. Vee analysis can point out similarities and differences among the text, instruction and the lab program. When these become apparent the students are more aware of concepts and relationships to be learned. Note the inclusion of thermocline under concepts.

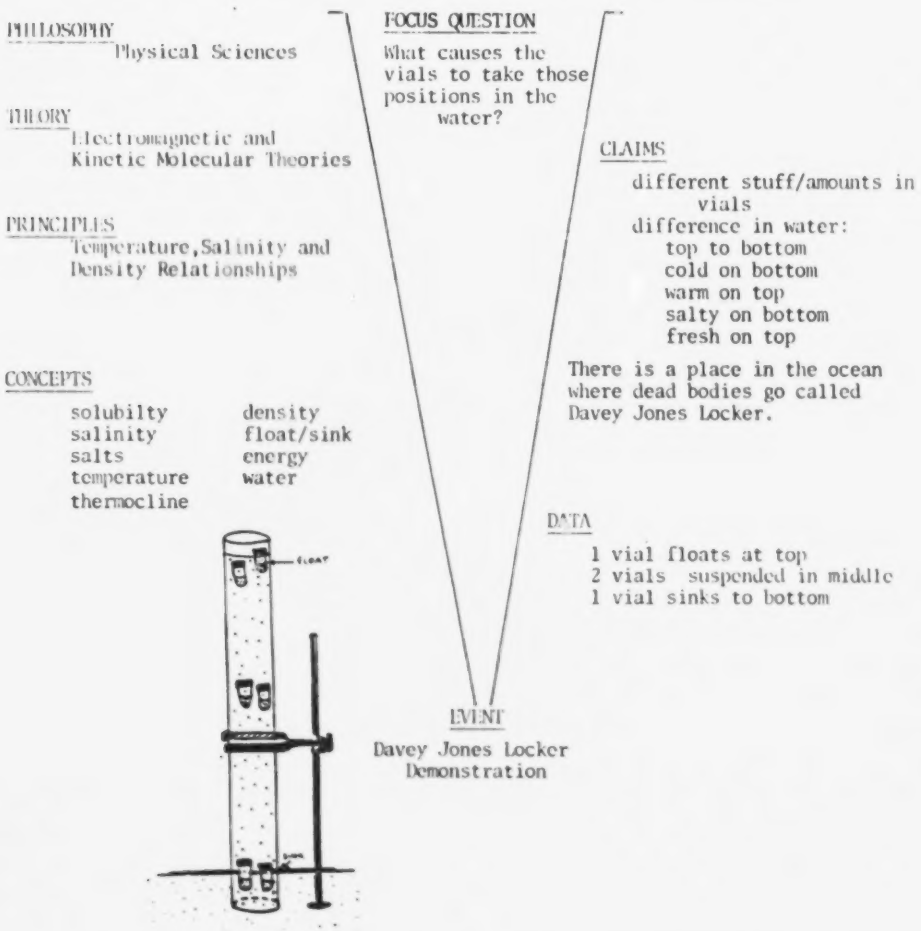
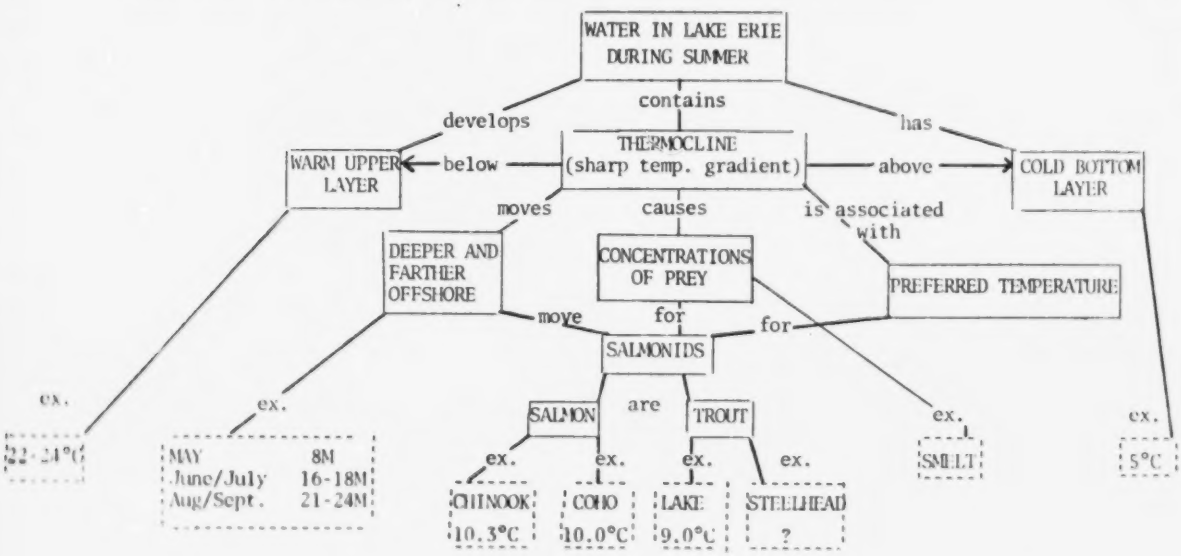


Figure 6. Vee analysis of Davy Jones' Locker demonstration. Note the similarity on the left side of the Vee analysis of the hydrometer in two samples of water (Figure 3.).

These mapping techniques can be used to analyze real world research and can help relate concepts that are similar to those students have learned in class. For example, recent research on salmon distribution in the Great Lakes funded by New York State Sea Grant has been investigating the question, "Where are the salmon during the summer months?" Tremendous numbers of fish have been stocked in recent years to provide attractive prey for anglers and to increase commercial recreation and tourism. However the fish have only been caught in Spring and Fall. Researchers have constructed research events and reports of their results are readily available from Sea Grant extension offices. An abstract of one of these reports is Concept Mapped in figure 7. Three short paragraphs, easily understood by science students, illustrate the key role of thermocline in summer salmon distribution.



Source: Lichorat,R.M., Summer Distribution of Salmonids in Eastern Lake Erie, May 1982 New York Sea Grant (project no. 124-S004E)

Figure 7. Concept Map constructed from Salmonid Research Project abstract. Temperature and thermocline play a central role in the distribution of salmon in Lake Erie.

The Vee Analysis of a 1981 summer netting project in Lake Ontario (see Figure 8.) is a comprehensive, concise one page summary of a New York Sea Grant extension information bulletin for charter boat captains and fishermen. The bulletin, although three and a half pages of text and two pages of graphs, is easily understood by science students and could be used to reinforce physical marine science concepts through Vee Mapping a real research event that will effect great numbers of people. Note the concepts of temperature, density and thermocline and their relationship to salmon and their prey species. Here classroom concepts are linked to research and the real world. However it is often the case in Vee Analysis of research that principles, theory of philosophy are not included in the reports. In these cases students can use the Vee and fill in the empty spaces based on information from classroom instruction.

Conclusion

Concept and Vee Mapping are valid techniques for teachers who wish to increase student understanding and learning. The integration of curriculum, research and student is a worthwhile strategy for helping students to learn concepts and their application to reality.

The events described in this paper are only examples of educative episodes that are enriched and clarified by use of Concept Mapping and Vee Mapping. These mapping tools, when used with students, can help them learn about the structure of knowledge and about learning to learn.

Curriculum development - the design of educational events - is critical to sharing meaning with students. Those events which most clearly illustrate the concepts to be taught can be developed and analyzed using Concept and Vee Maps. Educative events can be designed from scientific research events which use the same concepts.

VEE ANALYSIS OF SUMMER NETTING FOR LAKE ONTARIO SALMONIDS: 1981 RESULTS, Winter,etal, NYS Sea Grant 1982

PHILOSOPHY

Sea Grant Funding

FOCUS QUESTIONS

What are the seaonal movements, distributions and habitat preferences of Lake Ontario salmonids?

What are the locations and habitat preferences of Pacific Salmon and Steelhead Trout in the summer?

VALUE CLAIMS

Finding chinook salmon within 3 miles of shore is good news for anglers.

THEORY

KNOWLEDGE CLAIMS

Chinook habitat preference will make them accessible to anglers.
Salmon may congregate near thermocline because prey species do.
Lake trout and chinook clearly prefer smelt while brown trout eat equal proportions of smelt and alewife.
Chinook predominate in or above, brown in and near and lake trout below or in the thermocline.

PRINCIPLES

Consistency with other studies.

TRANSFORMATIONS (see also figures 1 and 2 below)

species	N	relationship to thermo. below	in	above	% within 10ft. of bottom at intersection with thermo.	temp. range	mean temp.	% and min. temp. range
lake trout	50	55%	32%		35%	39-60°F	48±6.1°F	43%/43-[illegible]°F
chinook	9		59%	33%	1 individual	46-72°F	59±6.1°F	50%/57-6[illegible]°F
brown	46		49%		9%	41-72°F	54±8.3°F	

CONCEPTS

thermocline
temperature
density
depth
distance offshore
seasonal movement
prey species:smelt alewife
salmonids
temp.preference
preferred habitat
distribution

DATA

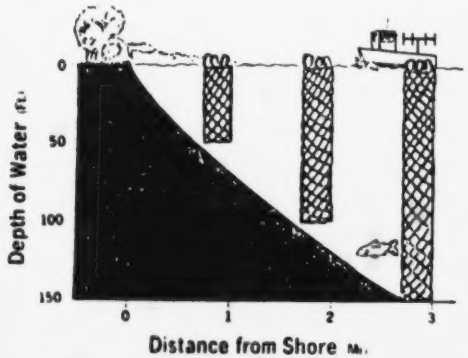
catch(adjusted for catch/unit effort=16chinook,154lake trout,62 brown trout.

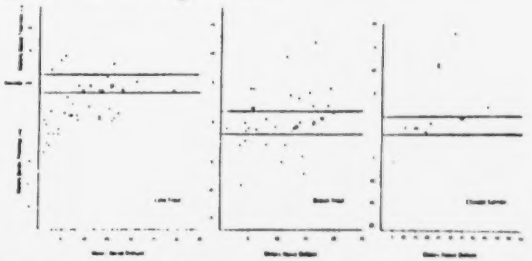
FACTS

thermocline averaged 13 ft. in width, 16-98ft. deep, 46-64 F
1 steelhead and two coho salmon were captured

EVENT

July to Sept. 1981, nets were set 3x/week in 50,100 and 150 feet of water within 3 miles of shore between Hamlin Beach and Braddock bay.
Analysis of stomach contents





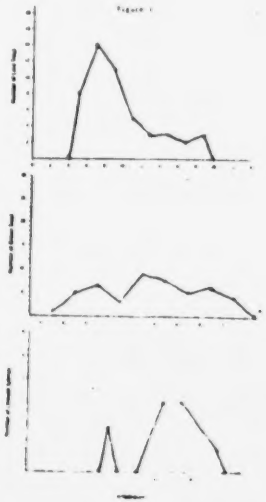


Figure 8. Vee analysis extension information bulletin concerning recent salmonid research. Note the same concepts as Hydrometer and Davy Jones' Locker Vees in Figure 3. and Figure 6.

Bibliography

Brody, Michael J. and B. Sharon Meeker, The UNH Floating Lab Resource Manual, UNH-MP-AR-SG-83-3.

Brody, Michael J., "The Floating Lab Project: An Approach to Evaluating Field Programs", unpublished manuscript. University of New Hampshire and Cornell University Department of Education, 1982.

Brody, Michael J., The Relationship of Primary Research Knowledge to the Identified Audience, unpublished Ph.D. proposal, Cornell University, May, 1983.

Gowin, D. Bob, Educating, Cornell University Press, Ithaca, New York, 1981.

Lichurat, Robert M., Summer Distribution of Salmonids in Eastern Lake Erie, New York Sea Grant Institute (project no. 124-S004E), 1982.

Novak, Joseph D., A Theory of Education, Cornell University Press, Ithaca, New York, 1977.

Novak, Joseph D. and D. Bob Gowin, "Concept Mapping, Vee Mapping and Clinical Interviews for Educating," unpublished manuscript, Cornell University Ithaca, New York, 1982.

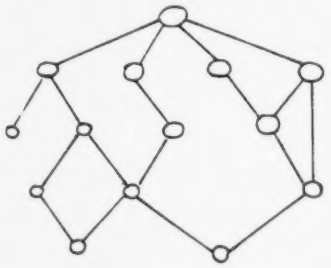
Weiss, Howard M., Michael W. Dorsey, Investigating the Marine Environment: A Source Book, Volume 2: Laboratory-Classroom Studies, Project Oceanology, 1979.

Winter, Jimmy D., Robert A. Olson, James M. Haunes and David C. Nettles, Summer Netting for Lake Ontario Salmonids: 1981 Results prepared by New York Sea Grant, April 1982.

Concept Mapping

INTRODUCTION

A proven method for making texts more comprehensible for teachers and students is Concept Mapping. Concept Maps help to identify key concepts and how they relate to each other. They provide a comprehensive way of outlining printed materials such as texts, research reports or even newspaper articles. Different Maps can be drawn to illustrate simple or complex meanings in the same text. While drawing Maps teachers often recognize new relationships and meanings in old and familiar material. Concept Maps can help students recognize key concepts that seem to be hidden in the text. Many times students in the midst of a course are frustrated by not knowing where the course or the instructor is headed. Teachers, don't lose your students, use a Map!



SCHEME OF CONSTRUCTION

most inclusive concept (general)

↓

least inclusive concepts (specific)

(1) O = concept represented as a word or phrase in an oval or box

(2) connecting lines = action words each line must be labelled to show relationships between concepts

(3) cross lines are drawn to show integration of concepts

(4) concepts should be drawn on levels to show a distinct hierarchy

HOW TO BUILD A CONCEPT MAP

(1) identify 7 plus or minus 2 key concepts in a paragraph, research abstract or chapter and list them

(2) place the broadest and most inclusive idea at the top of the Map

(3) work down the paper and add more specific concepts

(4) join these with lines that are labeled with action or linking words(verbs)

(5) each concept-linking word-concept unit forms a proposition that reads like a sentence, concepts not in the text can be added to increase complexity and comprehensiveness, examples of concepts can be added at the bottom of the Map

SCORING CRITERIA

1. Concepts: are all the words given used in the Map? one point for each concept

2. Propositions: are the relationships valid? Two points each

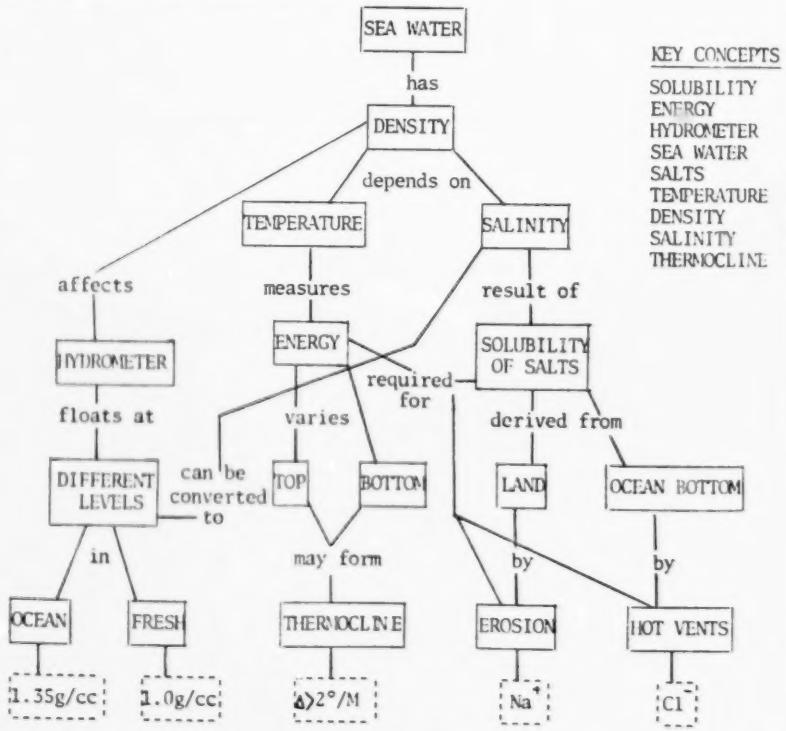
3. Hierarchy: are the concepts below more specific? are the general ones on top? five points for each valid level of hierarchy

4. Cross Links: are there horizontal lines showing meaningful relationships between different area of the Map? ten points for valid links between sets of concepts

(5) Examples: specific events or objects that are valid representations of concepts can be scored

SCORE FOR MAP AT RIGHT

concepts	17	x	1	=	17
propositions	17	x	2	=	34
hierarchy	6	x	5	=	30
crosslinks	2	x	10	=	20
					101
examples	5	x	1	=	5
					106 total



KEY CONCEPTS

SOLUBILITY
ENERGY
HYDROMETER
SEA WATER
SALTS
TEMPERATURE
DENSITY
SALINITY
THERMOCLINE

prepared by:Michael Brody,Department of Education,Cornell University,Ithaca,N.Y.14853 7/83

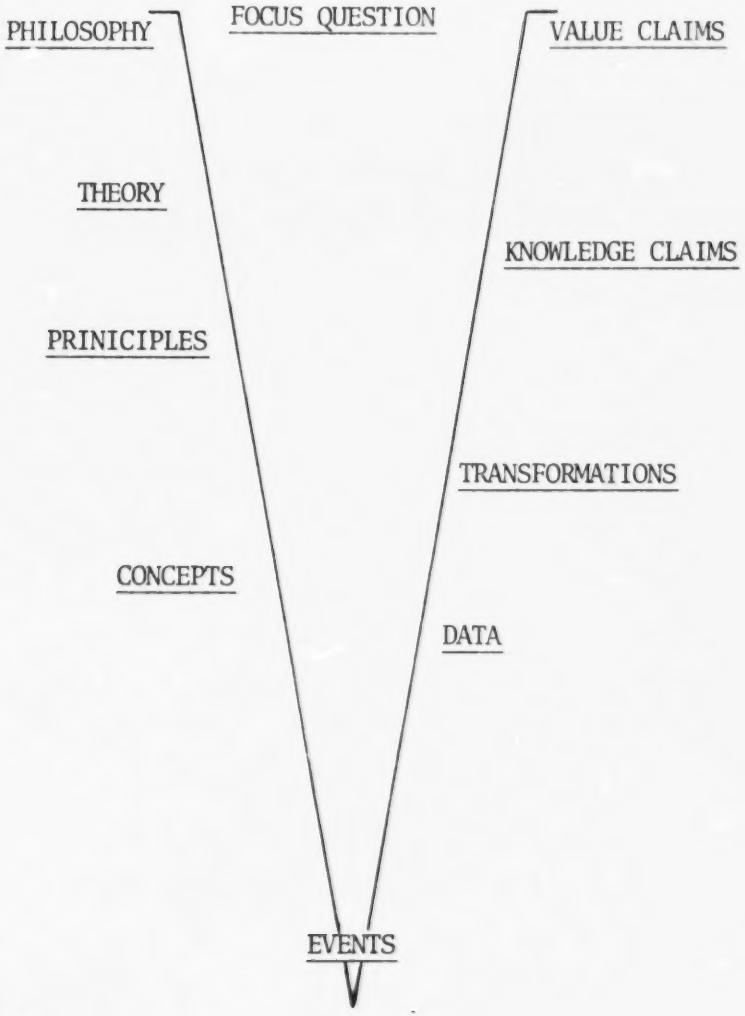


Figure 9. Use this Vee outline to help guide students through laboratory, field trips and analysis of research.